(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Veröffentlichungsnummer:
(11) Publication number:
(11) Numéro de publication:

1 059 853

Internationale Anmeldung veröffentlicht durch die Weltorganisation für geistiges Eigentum unter der Nummer:

WO 99/44446 (art.158 des EPÜ).

International application published by the World Intellectual Property Organisation under number:

WO 99/44446 (art.158 of the EPC).

Demande internationale publiée par l'Organisation Mondiale de la Propriété sous le numéro:

WO 99/44446 (art.158 de la CBE).

BNSDOCID: <EP_____1059853A0_I_>

PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : A24C 5/35, B65G 21/18

A1

(11) International Publication Number: **WO 99/44446**

(43) International Publication Date: 10 September 1999 (10.09.99)

(21) International Application Number: PCT/PL99/00004

(22) International Filing Date: 26 February 1999 (26.02.99)

(30) Priority Data:
P.325109 2 March 1998 (02.03.98) PL

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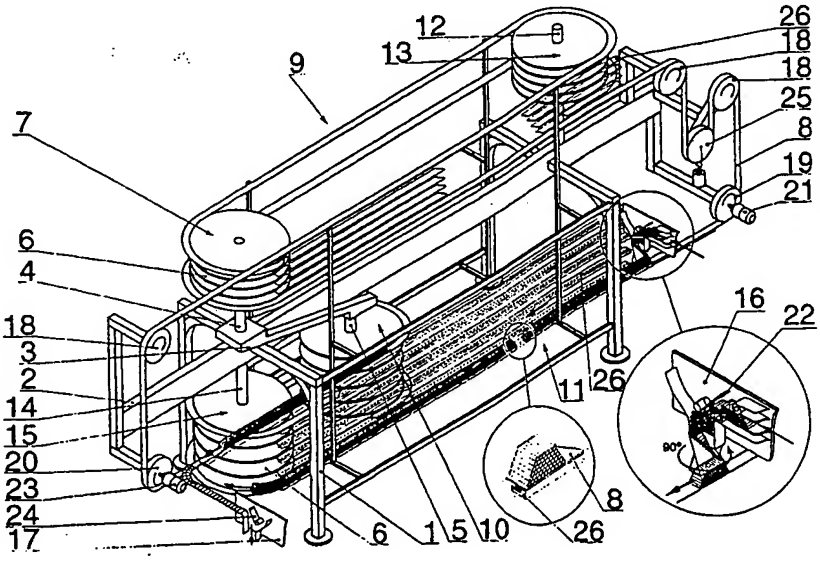
(81) Designated States: BG, BR, CA, CN, CZ, HU, JP, KR, MX, RO, RU, SK, TR, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.
With amended claims.

(54) Title: VARIABLE–CAPACITY BUFFER STORE FOR ROD–SHAPED ARTICLES

(57) Abstract



In the store at the inlet of the transport sector (11) is situated the first drive means (21) of the conveyor (8) connected to the follow up system controlled by the fullness sensor (22) assembled in the input station (16) and in the outlet of the transport sector (11) is situated the second drive means (23) connected to the follow up system controlled by the fullness sensor (24) assembled in the output station (17), while the transport sector (11) is defined by two, active and passive, identical support guide means (10, 15) for the conveyor (8), consisting of the independent disc modules (6) assembled rotary on the axes (5, 14), moreover the return sector (9) consists of the two, active and passive, identical support guide means (7, 13) of the conveyor (8), that consist also of independent disc modules (6) assembled rotary on the axes (4, 12), while the axis (5) of the active support guide means (10) in the transport sector (11) is fixed to the axis (4) of the active support guide means (7) in the return sector (9), by the carriage (3) assembled moveable on the horizontal guide bar (2), of the frame (1) of the store in the plane perpendicular to the axes (5, 4). Moreover the disc modules (6) are assembled slant against the axes (4, 5, 12, 14) of the support guide means (7, 10, 13, 15), and also the planes of the disc modules (6) in every support guide means (7, 10, 13, 15) are parallel each one to other and axes (4, 5, 12, 14) are situated beneficially in the one plane. Moreover the input station (16) and the output station (17) can be situated perpendicular to the conveyor (8) trajectory. The store has the tightener device (25) for the conveyor (8) and moreover the horizontal guide bars (26) assembled to the frame (1) in the zone of acting of the support guide means (7, 10, 13, 15), below the conveyor (8).

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VARIABLE-CAPACITY BUFFER STORE FOR ROD-SHAPED ARTICLES

An object of the invention is a variable-capacity buffer store for rod-shaped articles designed particularly for storing cigarettes supplied from a production machine and transferring cigarettes to a receiving machine e.g. packing machine. This store is used for compensating the differences between the work speed of those two co-operating machines.

The known modern production lines for the production and the packing cigarettes comprises, the production machine or set machines for the production of the cigarettes and the packing machines or set packing machines, to compensate the inequal efficiency of the both mentioned machines, the different storing apparatus are used in the production lines situated between the production machine and the packing machine. Due to the technological reasons, most suitable store apparatus work in the system first in first out. This system eliminates drawbacks, which exist in the system first in, last out, where the cigarettes can stay in the store for a long time. Moreover, in due to the enormous work speed, efficiency reachs 14000 cigarettes per minute, than every break or slow down one of the machines in the line, force using the compensating buffer store apparatus with a big capacity. Only the variable-capacity store with the endless conveyor can be used, because the area assigned for the production cigarettes line is limited. It is known from the description of the German patent DE 4.224.609, the variable-capacity store working in the system first in, first out, which comprises the transportation device for multilayers stream of the cigarettes, transported along the helical track. The store consists the first and second transportation section connected in series from the input station to the output

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station which is situated at the ends of the mentioned helical track. The first and second transportation section is combined together by the deflecting device which drives the both sections in that way, to change properly, the length of the transportation section occupied by the cigarettes, that means change the capacity of the store. In the described variable-capacity store, in the place where the first section combines with the second section, transported by the deflecting device, the cigarettes are constantly pressed by mentioned deflecting device, what can damage them. Another construction of the variable-capacity store for elongated elements, in particular tobacco products working in the system first in, first out is known from the description of the European patent application EP.738.478. Mentioned store comprises the input station and the output station located in series along the trajectory, along which the elongated articles are transported, and also the conveying means, with the variable length for transporting those elements, situated between the input station and the output station. Mentioned conveying means comprises the endless conveyor, situated in the transport sector, where the elongated elements are stored and in the return sector where the conveyor is empty. The conveyor length in the sectors are variable and compensate each other in a manner that total conveyor length is constant. The transport sector is located between the input station and the output station, the return sector is located between the output station and the input station. Moreover the store consists of the devices for changing the conveyor length in every sector in a manner that, their length compensate each other. These devices have the first drive means connected to the transport sector which can regulate the conveyor length of the first spiral in the define changes in that sector and the second drive means connected to the return sector which can regulate the conveyor length of the second spiral in the define changes in that sector. Equally the first spiral in the transport sector and the second spiral in the return sector are supported by the drums where, at least one in every sector can change their position being driven by the motor, which is the part of said variable devices for vary the conveyor length in every sector. The first and second spiral is wond on the proper assemble of the two drums remaining identical distances between curvatures or in the different distances for every sector. The conveyor spirals of the both sectors are situated beside, or the second conveyor spiral of the return sector is situated inside the first spiral of the transport sector. This solution demands very complicated, in respect to the regulation means, also mechanical, devices for changing the conveyor length in the both sec-

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tions, by which is possible to obtain the proper change length of the spiral in every sector after the signal is received from the sensor situated at the output of the cigarettes production machine, and the input of the packing machine. Moreover the store depicted in the description and figures will be difficult to realise in respect to significant friction between the conveyor and drums, specially under the full load of the conveyor in the transport sector.

An object of the invention is the construction of the variable-capacity buffer store for rod-shaped articles working in the system first in, first out, comprising the input station co-operating with the production machine and the output station co-operating with the receiving machine. With said station co-operates, the continuous, endless conveyor for transporting the rod-shaped elements from the input station to the output station and the part of it is situated in the transport sector between the input station and the output station and the second part is situated in the return sector and by the way the length of the conveyor in sectors compensate each other. At the input of the transport sector is situated the first conveyor drive assembly connected to the follow up system controlled by the fullness sensor fixed in the output station and at the input of the return sector is situated the second conveyor drive assembly connected to the fullness sensor fixed in the output station. The transport sector is determined by the two, active and passive, identical conveyor support guide means, consisting of the two disc modules assembled rotary on the axes, and by the way, the axis of the active support guide means in the transport sector is fixed to the axis of the active support guide means in the return sector by the carriage assembled moveably on the horizontal guide of the frame of the store in the plane perpendicular to said axes. Equally in the transport sector and in the return sector, the disc modules are assembled slant to the axes of the support guide means, in a manner that, planes of disc modules in every support guide means are parallel. The axes of all support guide means in the transport sector and in a return sector are situated beneficially in the one vertical plane. At the maximum capacity of the store, the axis of the active support guide means is the continuation of the axis of the passive support guide means in the return sector, and at the minimum capacity, the axis of the passive support guide means in the transport sector is the continuation of the axis of the active support guide means in the return sector. The axes of the support guide means in the transport sector can be situated in the vertical plane, which is parallel to the plane defined by the axes of

the support guide means in the return sector. Below the conveyor in the transport and return sector in the zone of the activity of the support guide means are assembled the horizontal guide bars supporting the conveyor. Moreover the store is equipped with the tightener device of the conveyor. The input station and the output station are situated beneficially perpendiculary to the conveyor trajectory. This construction of the store enables temporary gathering the rod-shaped elements in the transport sector in a form of the continuous multilayer stream on the conveyor constructed of the segments and the maximum capacity of the store is defined by the maximum distance between the outer edges of the support guide means in the transport sector and by the amount of the employed disc modules in the support guide means situated there and by the height of the elements stream on the conveyor. The store adapts itself to the expected temporary capacity and the change of the capacity is done automatically after the differences occur between the conveyor speed in the zones of the output and the input stations and the demanded capacity is retained, by the proper conveyor length which is fitted by change of the carriage location, carrying with it the active support guide means, as only a result of the conveyor acting on the co-operating with it the disc modules of said means. The linear speed of the conveyor in the input station zone, depends on the amount of the elements incoming from the production machine and the linear speed of the conveyor in the output station zone, depends on the amount of the elements being received by the packing machine and these speeds vary in the continuous way. Perpendicular location of the input station and the output station against the conveyor trajectory, enable to locate the production line in a group form in the considerable small area.

An object of the invention is depicted as the example on Fig.1, which shows the store in the schematic form with the carriage determining the minimum capacity of the transport sector and for the better view of the individual elements, the conveyor and the guide bars are partially removed from the Fig.1, whereas some parts of the conveyor are shown additionally in the enlarged details, and the rod-shaped elements on the conveyor in the transport sector are shown fragmentarily .

The variable-capacity store accordingly to Fig.1, depictes the buffer store for cigarettes, located in the production line between the cigarettes production machine and the packing machine, whereas exists possibility, that the store co-operates with more than one production machine and simultaneously with more than one packing machine.

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The element supporting the store is the frame 1 situated on the ground, consisting of the horizontal guide 2 of the carriage 3, which can move to and fro. With the carriage 3 is fixed the vertical axis 4 directed upwards and the vertical axis 5 directed downwards, whereas the axes 4, 5 are situated in the one plane, but they do not cover each other. The disc modules are fixed on the axes 4, 5 ,whereas the axis 4 with the modules 6 constitute the active support guide means 7 of the conveyor 8 in the return sector 9 and the axis 5 with the modules 6 constitute the active support guide means 10 of the conveyor 8 in the transport sector 11. To the frame 1 is fixed the vertical axis 12 directed upwards on which is assembled the disc modules 6 and the axis 12 with modules 6 constitute the passive support guide means 13 of the conveyor 8 in the return sector 9. On the opposite end of the frame 1 is fixed the vertical axis 14 directed downwards on which are assembled the disc modules 6 and the axis 14 with the modules 6 constitute the passive support guide means 15 of the conveyor 8 in the transport sector 11. The disc modules 6 are independently and rotary mounted on all axes 4, 5, 12, 14, and all axes 4, 5, 12, 14 are situated on the one plane. The ending position of the active support guide means 10 of the conveyor 8 at the maximum distance between the axes 5 and 14 determine the maximum capacity of the transport sector 11. At the beginning of the transport sector 11, above the conveyor 8 is located perpendicular to the trajectory of the conveyor 8 the input station 16 receiving the cigarettes from the production machine, which is not shown on Fig. 1, and putting the multilayer stream of the cigarettes on the conveyor 8. At the end of the transport sector 11, there is situated perpendicular to the trajectory of the conveyor 8 the output station 17 transferring the pile of the cigarettes from the conveyor 8 to the packing machine, which are not shown on Fig. 1. The length of the spatial spiral of the conveyor 8 between the input station 16 and the output station 17 in the transport sector 11, determines the temporary capacity of the store. The conveyor 8 constituents the segment belt with the constant length which is simultaneously the belt for transporting the cigarettes and the pulling belt, changing direction of the trajectory by the disc modules 6, rollers 18 and driving rollers 19 and 20. The part of the conveyor 8 from the output station 17 to the input station 16 constitutes the return sector 9 in which the length of the conveyor 8 determine the distance between the axes 4 and 12 of the passive and active support guide means 7 and 13, whereas the length of the conveyor 8 in the transport sector 11 and the return sector 9 compensate each other. At the maximum capacity of the store, the axis 5

of the active support guide means 10 in the transport sector 11 constitutes the continuation of the axis 12 of the passive support guide means 13 in the return sector 9 and at the minimum capacity of the store, the axis 14 of the passive support guide means 15 in the transport sector 11 constitutes the continuation of the axis 4 of the active support guide means 7 in the return sector 9. Moreover the store capacity is determined by the amount of the layers of the conveyor 8 in the transport sector 11 corresponding to the amount of the disc modules 6 in every support guide means 10 and 15. The succeeding layers of the conveyor 8 are achieved by the slant assembly of the disc modules 6 on the axes 5 and 14, which causes change of the trajectory level of the conveyor 8 and the entry to the following layer occurs in the area of the contact with the circumference of the disc modules 6 which curvature constitutes the rising segment, changing direction 180 deg. and rise on every convolution is equal to a half distance of the centres of neighbour two disc modules 6. Whereas the straight segments of the spiral of the conveyor 8 are horizontal and parallel to each other and moreover the planes of the disc modules 6 in the support guide means 10 and also in the support guide means 15 are parallel. Accordingly, the amount of levels of the spiral of the conveyor 8 in the return sector 9 determines the amount of the disc modules 6 in every support guide means 7, 13 and the following levels of the spiral are obtained by the slant assembly of the disc modules 6 on the axes 4 and 12 what causes the change trajectory of the conveyor 8 and passing to the following level occurs in the area of contact with the circumference of the disc modules 6, which curvature constitutes the segment dropping and changing direction 180 deg. and drop on every convolution is equal to a half of the distance between the centres of the neighbour disc modules 6. Whereas the straight spiral segments of the conveyor 8 are parallel to each other and the plane of the disc modules 6 in the support guide means 7 and also in the support guide means 13 are parallel to each other. At the input of the transport sector 11, before the input station 16 is joined to the drive roller 19 first driving means 21 of the conveyor 8 connected to the follow up system controlled by the fullness sensor 22 installed at the input station 16, and at the output of the transport sector 11 after the output station 17, there is connected to the drive roller 20, the second drive means 23 connected to the follow up system controlled by the fullness sensor 24 installed in the output station 17. For eliminating looses of the conveyor 8 is employed the tightener device 25 consisting of the mechanical roller pushed by outdoor force. The conveyor 8 in every level of the

transport sector 11 in the area where operate the support guide means 10 and 15 and also in every level of the return sector 9 in the area where operate the support guide means 7 and 13 are supported on the guide bars 26 fixed horizontally to the frame 1.

An acting of the store is as follows: the cigarettes from the production machine are sent to the input station 16 and are transferred to the conveyor 8 as the multilayer stream with the constant height. Every change of the amount of the sending cigarettes is detected by the fullness sensor 22, which is constructed as the deflective arm. The varies of the angle of the arm deflection, generates an electrical signal, which after the proper treatment constitutes the basic parameter determining current supplying the motor in the first drive means 21 combined to the drive roller 19 of the conveyor 8. The parameters of the signals are chosen in a manner that, the motor follows the temporary changes in the amount of the coming in cigarettes, enables to remain the multilayer stream of the cigarettes in the constant height and continues move of the conveyor 8 with the speed different than 0. In a case, the production cigarettes machine is arrested or the amount of the supplied cigarettes to the input station 16 is diminished below the critical point, the drive means 21 is stopped and also with it the conveyor 8 is stopped in the place where it touches the drive roller 19. Accordingly in the output station 17 cigarettes are transferred to the conveyor 8, to the packing machine and the amount of the received cigarettes is shown by the fullness sensor 24 mounted in the output station 17 in a form of the deflective arm. Every change in the receiving cigarettes caused e.g. by slow down of the packing machine, makes changes of the arm deflecting angle, what generates an electrical signal, which after the proper treatment, constitutes the basic parameters determining voltage for the motor in the second drive means 23 combined to the drive roller 20 of the conveyor 8. The parameters of the signals are chosen in a manner that, the motor follows after temporary changes in the amount of receiving cigarettes, enables remaining of the proper level of the cigarettes in the filling device in the packing machine. In a case the packing machine is arrested the drive means 23 is stopped and with it conveyor 8 is stopped in the place where it touches the drive roller 20. The differences in the speed of the conveyor 8 in the input and output of the transport sector 11 force movement of the carriage 3 and beside the changes are linear. In a case when the amount of the cigarettes supplied from the production machine is equal to the amount of the cigarettes received by the packing machine, carriage 3 does not change its position. Therefore an arresting of the production

cigarettes machine, at the normal rate of the work of the packing machine and immobilising of the drive roller 19 and also immobilising with it the conveyor 8 at the input of the transport sector 11 causes an automatic movement of the carriage 3 towards to the axis 14 of the passive support guide means 15 and the decreasing of the spirals of the conveyor 8 loaded by the multilayer stream of the cigarettes in the transport sector 11, at the simultaneous increment of the spiral of the conveyor 8 in the return sector 9 until the extreme point, when the production line will be switched off automatically. Similarlly an arresting of the packing machine at the normal rate of work of the production cigarettes machine and immobilising of the drive roller 20 and also immobilising with it the conveyor 8 at the output of the transport sector 11, causes an automatic movement of the carriage 3 towards to the axis 12 of the passive support guide means 13 and the increment of the spiral of the conveyor 8 loaded by the multilayer stream of the cigarettes in the transport sector 11 at the simultaneous decrement of the spiral of the conveyor 8 in the return sector 9 until the extreme point, when the production line will be automatically switched off.

CLAIMS

1. A variable-capacity buffer store for rod-shaped articles working in the system first in, first out, comprising the input station connected to the production machine and the output station connected to the receiving machine, co-operating with the continuous endless conveyor, carrying rod-shaped articles from the input station to the output station, which part is situated in the transport sector and the second part is situated in the return sector, by the way, the length of the conveyor, in the both sector compensate each other characterised in that, at the inlet of the transport sector 11 is situated the first drive means 21 of the conveyor 8 connected to the follow up means which is controlled by the fullness sensor 22 assembled in the input station 16 and at the exit of the transport sector 11 is situated the second drive means 23 of the conveyor 8, connected to the follow up means controlled by the fullness sensor 24 assembled in the output station 17, by the way the transport sector 11 consists of the two, active and passive, identical support guide means 10, 15, of the conveyor 8 that consist of the independent disc modules rotary assembled in the axes 5, 14, the return sector 9 consists of the two active and passive, identical support guide means 7, 13 of the conveyor 8 that consist of the independent disc modules 6 rotary assembled in the axes 4, 12, by the way the axis 5 of the active support guide means 10 in the transport sector 11 is fixed to the axis 4 of the active support guide means 7 in the return sector by the carriage 3 moveable assembled on the horizontal guide bar 2 on the frame 1 of the store in the plane perpendicular to the axes 5, 4.
2. A variable-capacity store as claim 1, characterised in that, the disc modules 6 are assem-bled slant against the axes 4, 5, 12, 14 of the support guide means 7, 10, 13,

15 and by the way the plane of the disc modules 6 in every support guide means 7, 12, 13, 15 are parallel to each other.

3. A variable-capacity store as claim 2, characterised in that, the axes 4, 5, 12, 14 of all support guide means are situated in the one vertical plane.
4. A variable-capacity store as claim 2, characterised in that, the axes 5, 14 of the support guide means 10, 15 in the transport sector 11 are situated in the vertical plane while, the axes 4, 12 of the support guide means 10, 15 in the return sector 9 are situated in the parallel vertical plane.
5. A variable-capacity store as claim 3, characterised in that at the maximum capacity of the store, the axis 5 of the active support guide means 10 in the transport sector 11 is the continuation of the axis 12 of the passive support guide means 13 in the return sector 9 and at the minimum capacity of the store the axis 14 of the passive support guide means 15 in the transport sector 11 is the continuation of the axis 4 of the active support guide means 7 in the return sector 9.
6. A variable-capacity store as claim 1, characterised in that, below the conveyor 8 in the transport sector 11 and in the return sector 9 in the zone of acting the support guide means 7, 10, 13, 15 are assembled to the frame 1, the horizontal guide bars 26 supporting the conveyor 8.
7. A variable-capacity store as claim 1, characterised in that consists of the tightener device 25 of the conveyor 8.
8. A variable-capacity store as claim 1, characterised in that, the input station 16 and the output station 17 are situated perpendicular to the conveyor 8 trajectory.

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AMENDED CLAIMS
[received by the International Bureau on 3 August 1999 (03.08.99), original claim 4 amended; remaining claims unchanged (1 page)]

15 and by the way the plane of the disc modules 6 in every support guide means 7. 12. 13. 15 are parallel to each other.

3. A variable-capacity store as claim 2. characterised in that. the axes 4. 5. 12. 14 of all support guide means are situated in the one vertical plane.

4. A variable-capacity store as claim 2. characterised in that. the axes 5. 14 of the support guide means 10. 15 in the transport sector 11 are situated in the vertical plane while. the axes 4. 12 of the support guide means 7. 13 in the return sector 9 are situated in the parallel vertical plane.

5. A variable-capacity store as claim 3. characterised in that at the maximum capacity of the store. the axis 5 of the active support guide means 10 in the transport sector 11 is the continuation of the axis 12 of the passive support guide means 13 in the return sector 9 and at the minimum capacity of the store the axis 14 of the passive support guide means 15 in the transport sector 11 is the continuation of the axis 4 of the active support guide means 7 in the return sector 9.

6. A variable-capacity store as claim 1. characterised in that. below the conveyor 8 in the transport sector 11 and in the return sector 9 in the zone of acting the support guide means 7. 10. 13. 15 are assembled to the frame 1. the horizontal guide bars 26 supporting the conveyor 8.

7. A variable-capacity store as claim 1. characterised in that consists of the tightener device 25 of the conveyor 8.

8. A variable-capacity store as claim 1. characterised in that. the input station 16 and the output station 17 are situated perpendicular to the conveyor 8 trajectory.

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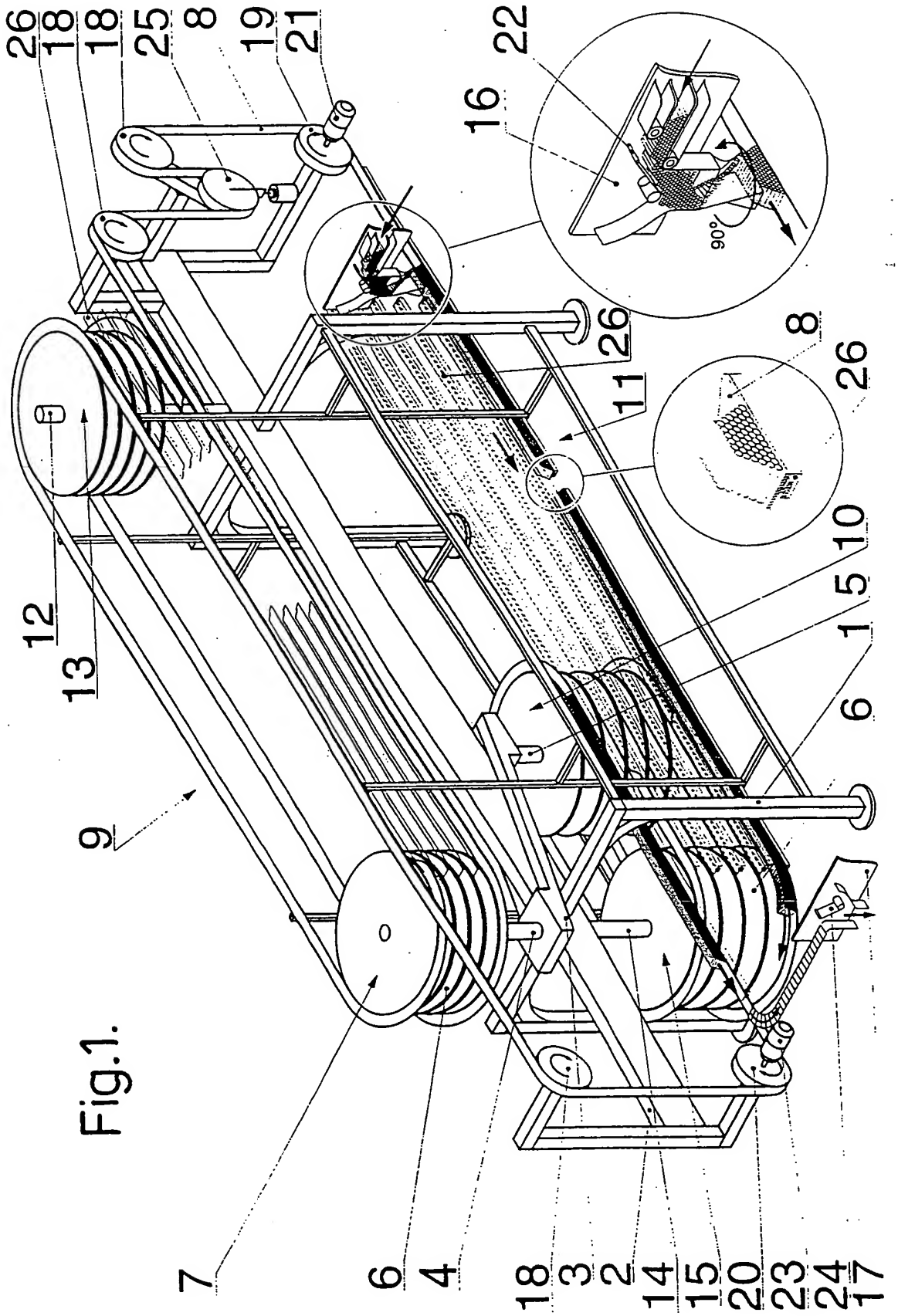
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Fig.1.

INTERNATIONAL SEARCH REPORT

Inte onal Application No
PCT/PL 99/00004

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A24C5/35 B65G21/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A24C B65G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 738 478 A (G.D. SOCIETA PER AZIONI) 23 October 1996 cited in the application see the whole document ---	1
A	DE 42 24 609 A (KÖRBER AG) 27 January 1994 cited in the application see the whole document -----	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
22 June 1999	29/06/1999

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter ional Application No
PCT/PL 99/00004

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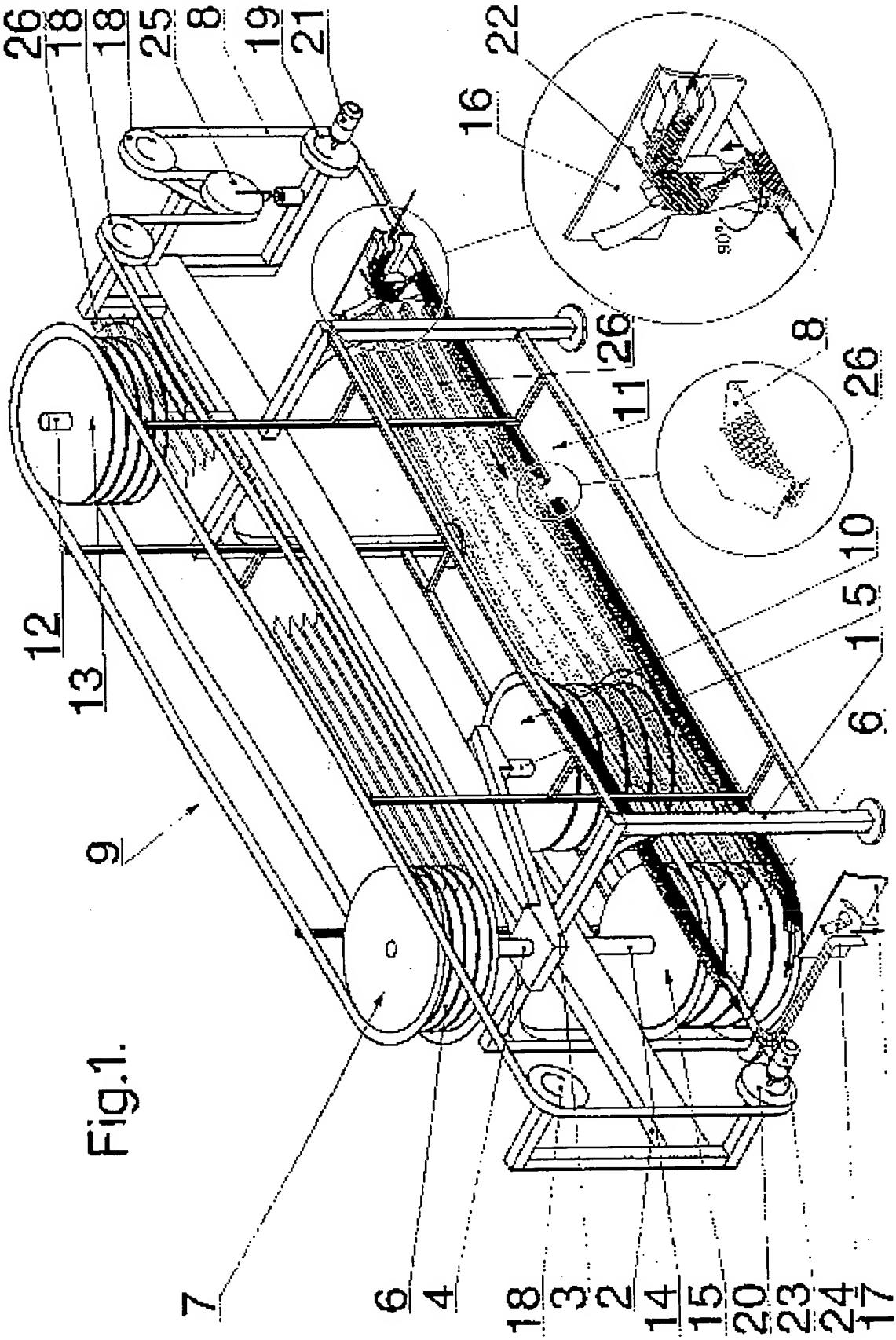
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Fig.1.